Rainbow Tube

Instructions

Materials:
Clear Polycarbonate Tube Lamp Guard (available at hardware stores)
Universal Indicator
1.0 M $HCl_{(aq)}$ hydrochloric acid
0.1 M $NaOH_{(aq)}$ sodium hydroxide
Water

Safety Precautions: Sodium hydroxide and hydrochloric acid are corrosive chemicals. Wear chemical-resistant gloves and goggles.

Set Up:
1. Remove one end cap from the tube guard and fill the tube with water. Leave some room on top.
2. Add universal indicator from one end, cap the tube, and carefully tilt to the other side.
3. Add universal indicator from the other end, cap the tube, and carefully mix the solution for a minute. The neutral solution should be a dark green color.

Demo Procedure:
1. Add 0.1 M $NaOH_{(aq)}$ from one side of the tube. Point out the dark blue colored basic solution close to this end due to the addition of the NaOH. Cap the tube securely.
2. Add equal volume of 1.0 M $HCl_{(aq)}$ from the opposite side of the tube. There is an instant change from the green solution to a bright red solution. Cap the tube securely.
3. Slowly tilt the tube back and forth to create a rainbow colored effect of red, orange, yellow, green, blue, and purple; as the pH of the solution in the tube gradually shifts from acidic to neutral to basic.

Troubleshooting: The rainbow colored effect in the tube seemed to work best if the amount of hydrochloric acid added is slightly more than sodium hydroxide in order to maintain the red end of the rainbow colored solution.

Waste Disposal: The final solution should be neutral (green in color) and can be poured down the drain. If the solution is slightly acidic (yellow-red colored), it can be neutralized safely with sodium bicarbonate (baking soda). If the solution is slightly basic (blue colored), it can be neutralized safely with household distilled vinegar (~5-8% acetic acid).